

MODERN Machine Shop

HOWARD CAMPBELL, Editor

Volume 6

JULY, 1933

Number 2

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*A
Magazine
for
Machine
Shop
Executives*

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MODERN Machine Shop

JULY, 1933

CINCINNATI, OHIO

VOL. 6, No. 2

Some Interesting Operations on Parts for "Crosley" Refrigerators

BY HOWARD CAMPBELL

ONE of the first statements in the Crosley electric refrigerator catalog is "All essential parts of the Crosley electric refrigerator are designed by Crosley engineers and made in the Crosley factory under the most approved refrigerator manufacturing practices." Inasmuch as the electric refrigerator is now standard equipment in a representative number of American homes, a description of the manner in which these parts are ma-

chined should be of interest to a large number of mechanical executives.

The most important part of the refrigerating unit is the compressor body, which comprises the cylinder and crankcase, cast as a single unit. The first machining operation on the compressor body is, of course, that of machining the top and bottom and opposite sides. The top and bottom are finished at a single pass in the milling machine shown at the right in

Fig. 1—The top, bottom and sides of the compressor unit are machined in these milling machines.



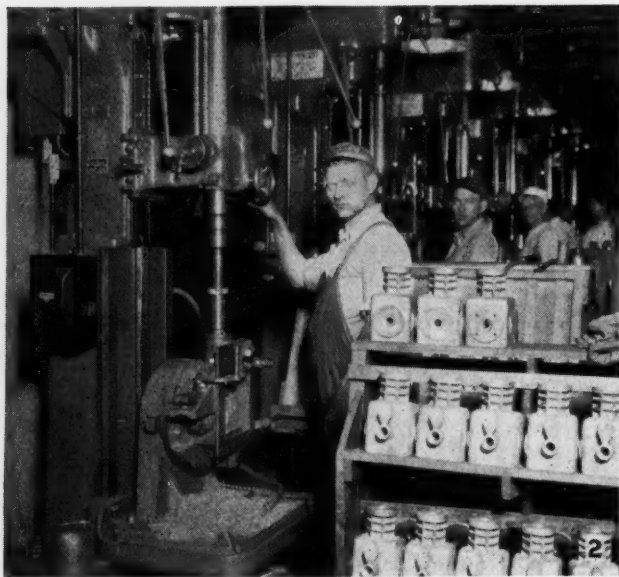


Fig. 2—The piston holes and crankshaft holes in the compressor bodies are machined to size in these drilling machines.

Fig. 1, and the sides are finished in the machine at the left. The cutters are set to the dimension specified, and the fixtures are made to hold two castings each, which evens the cutting and handling time so that both the cutters and the operator are kept busy.

Figure 2 shows a battery of Cincinnati Bickford "Super Service" drilling machines, each of which is employed to rough ream, bore, and finish ream the cylinder bores and bore and ream the crankshaft holes in the compressor bodies. As can be seen by a study of the fixture on the first machine in the line, the piece is machined in a swing jig which aligns the work instantly and correctly, and which can be indexed to bring either the shaft hole or the cylinder into line with the machine spindle. The cylinder is

reamed to 1.485 in., leaving 0.015 in. to be removed by diamond boring in a subsequent operation. The crankshaft hole is reamed to 0.735 in., also leaving 0.015 in. to be removed by diamond boring.

In Fig. 3 is shown a drill press that has been rigged for tapping the cover holes in the end of the crankcase. A reversing head is used, attached to the spindle of the machine, and the work is located

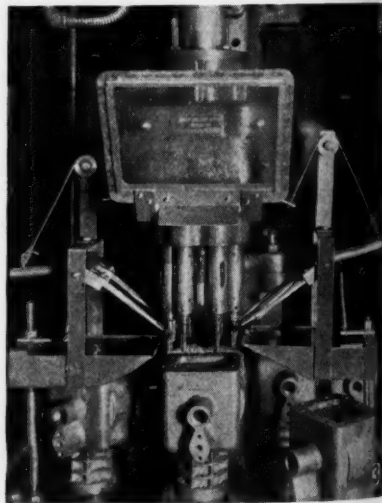


Fig. 3—The feature of this operation is the arrangement for automatically oiling the taps. Each tap is positively and thoroughly oiled between operations.

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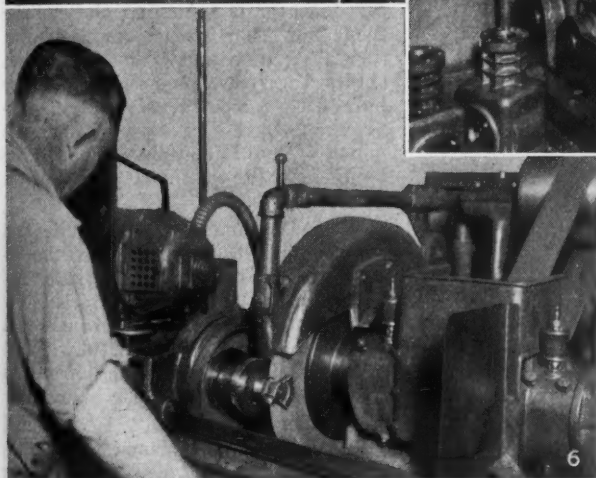
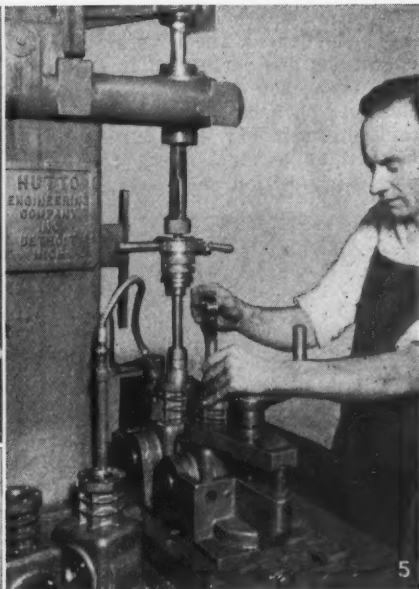
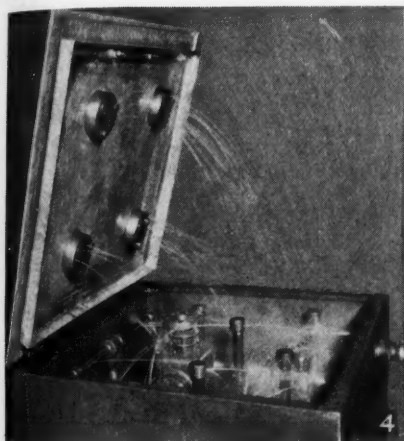


Fig. 4—A stream of warm kerosene oil is squirted into each hole in the compressor body. Four bodies are cleaned at a time, and four minutes is sufficient to thoroughly clean all the holes. Fig. 5—Piston holes are honed to size with the equipment shown here. Limits of 0.0005 in. are allowed on this dimension. Fig. 6—Grinding the bearing on the eccentric. The limit on this fit is 0.0002 inch.

for tapping on a single stud, where it is held by the operator's hand. The feature of this operation is the manner in which the taps are automatically oiled between tappings. A frame at each side of the machine holds a set of brushes, one for each of the taps on the nearest side. The brushes are held in a rack with a rear stud that is pulled downward by a spring, but to which is attached a cable which is also attached to the tapping head.

As the head feeds downward, the stud is pulled upward and the brushes tilt downward until they are immersed in a tank of oil. As the head rises, the spring pulls the stud down and the brushes are tilted upward, ultimately wiping the entire length of the taps. This contrivance not only makes it unnecessary for the operator to oil the taps, but it assures positive lubrication to each tap and does the job more thoroughly than is possible by the hand method.

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All the holes in the crankcase having been drilled, the several tapping operations are performed in sequence and then the case is thoroughly cleaned by washing in kerosene in the tank shown in Fig. 4. Four cases are washed at a time, each case being placed in position on a base from the

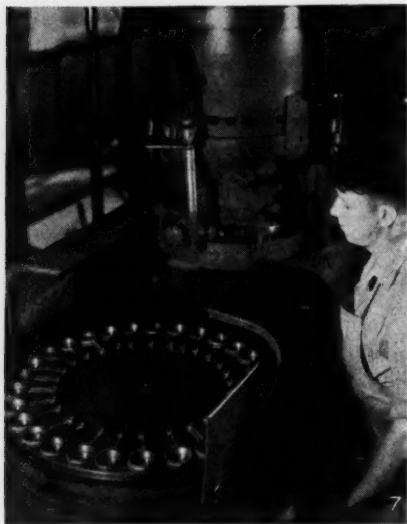


Fig. 7.—The faces of 40 connecting rods, held by a magnetic chuck on the table of this vertical surface grinder, are ground at one setting.

center of which a vertical section of pipe extends. The holes in the lower end of the case are faced by corresponding holes in the base, and as the tank-cover is closed over the cases, the upper end of each cylinder is covered by a cylindrical projection with holes that face the tapped holes in the end of the cylinder. The cap on the end of the vertical pipe also contains a series of holes, and there are several cross-arms in which fine holes are drilled.

As the cover is closed down over the cases, the pump is automatically started and the oil is sprayed into the tapped holes in the case. There are 6 holes in the top, 4 on one side,

3 on the other side, and 8 on the bottom, each of which receives a direct stream of warm kerosene under heavy pressure. The cases are washed in four minutes, which length of time has been found sufficient for a thorough job of cleaning.

In order to obtain the glass-smooth finish and perfect accuracy necessary in the construction of a small compressor unit, the piston holes are honed to size with the aid of the Hutto honing equipment shown in use in Fig. 5. Two fixtures are used, held in position on the machine-table by guides and located for alignment with the machine-spindle by stops. While the cylinder in one fixture is in process, the operator is removing the cylinder from the other fixture and replacing it with a new one. The illustration shows the operator gaging a piston hole with a special dial gage. Approximately 25 cases per hour are honed with this equipment, each piece being held to within 0.0005 in. of the drawing size.

A more common operation is that of grinding the bearing on the eccentric, as illustrated in Fig. 6. Approximately 0.010 in. of stock is removed and the piece is ground to a diameter of 2.3135 in., within a limit of 0.0002 in. The production on this operation is 40 pieces per hour.

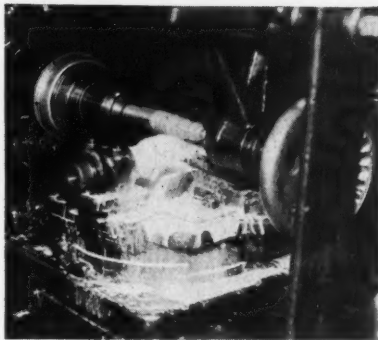
Another piece that is machined to very close dimensions is the connecting rod. The first operation on the rod is that of rough facing the sides, which is done on a disc grinder. Forty rods are then placed in a circle on the table of a vertical surface grinder, as shown in Fig. 7, and the upper surfaces are finished. The rods are then turned over and the opposite sides are ground, the rods being finished to a thickness of 11/16 in. scale measurement, or 0.005 in. plus or minus. The 40 rods are finished on this operation in ten minutes.

Figure 8 is a view of the "borizing"

OPERATION: Rough Cut and Finish from Solid Stock. Transmission Helical Spline Shafts.

MACHINE: Barber-Colman Gear Hobber.

MATERIAL: S.A.E. 3115.



*Courtesy Canadian Acme Screw and Gear, Ltd.,
Toronto, Ont., Canada*

PRODUCTION: 8 Pieces Per Hour.

LENGTH AND DEPTH OF CUT: 6.25 in. Long and .128 in. Deep on Each Side.

LUBRICANT: 1 Part Sunoco to 6 Parts Water.

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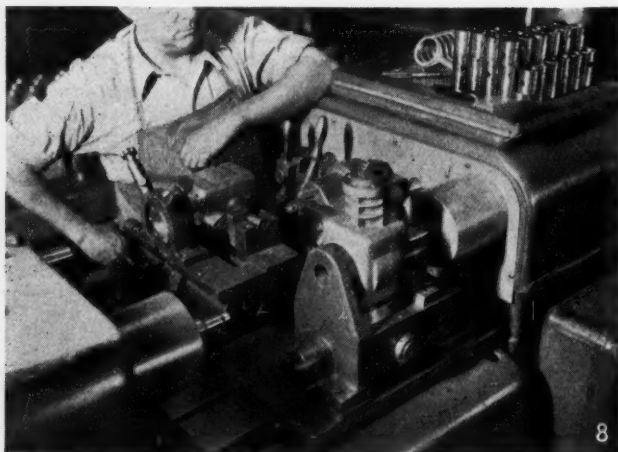


Fig. 8—The working fits on all the more important parts in the compressor are bored to size in this "boring" machine, using tools that are tipped with tungsten carbide. Six different operations on five different parts are performed in one setting.

machine in operation. The machine is essentially a diamond boring machine, with the exception that the tools are tipped with tungsten carbide cutters. The tools and fixtures are arranged on this machine so that the wristpin hole in the piston, the eccentric hole in the connecting rod, the wristpin hole in the connecting rod, the two crankshaft holes in the opposite sides of the crankcase, and the piston hole in the cylinder are machined at one setting.

The machine has two heads, with two spindles in one head and four in the other. As the operation starts, the work table,

carrying the work, feeds toward one head and the operations of boring one side of the crankcase, the eccentric and wristpin holes in the connecting rod, and the wristpin hole in the piston are completed. The table then reverses and the opposite hole in the crankcase and the piston hole in the cylinder are finished. The piston hole in the cylinder is held to within 0.0007 in. of drawing size; the crankshaft bearing holes in the case are held to within 0.0003 in.; the bear-



Fig. 9—"Bearinizing" a connecting rod. The rod is mechanically peened in this machine, the operation having the same effect upon the surface of the metal as would be achieved by a year of actual service.

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ing holes in the connecting rod are held within 0.0002 in., and the wristpin hole in the piston is held within 0.0002 in. The pieces are locked in position, bored, and removed in 2½ minutes complete.

A comparatively recent development in hole-finishing is a mechanical peening operation that is termed "bearinizing." In this operation the interior of the hole is mechanically peened by means of a tool that strikes a series of light, but effective, blows on the surface of the metal while revolving at a high rate of speed, compressing the metal and producing a round hole with a hard surface. The effect upon the metal in the surface of the hole is practically the same as would be produced by a year of actual operation; that is, the hole is "broken in" and the metal is hardened to such a point that further wear will be practically imperceptible.

The "bearinizing" operation is shown in process in Fig. 9, where the operator can be seen bearinizing the eccentric hole in a connecting rod. The bearinizing tool, shown in Fig. 10, consists primarily of a shaft upon which a series of small flats have been milled, and a series of rollers which revolve around the shaft at high speed. As the rollers ride up over the corners between the flats, they strike the metal in the surface

of the hole, each roller striking the metal some 25 times in the course of one revolution of the tool. The blow struck by each roller is light, but with 25 rollers in the tool, operating at a speed of 2,000 r.p.m., the metal is compressed from 0.0004 to 0.0006 in. in a few seconds.

The tool shown in Fig. 10 is 2 5/16 in. in diameter, and the flats are

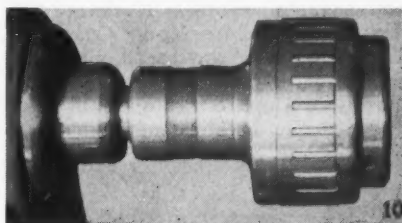


Fig. 10—The "bearinizing" tool. With the tool revolving at a speed of 2,000 r.p.m., the rollers strike a series of light hammer blows on the surface of the metal, compressing it.

milled 3/32 in. wide with 3/32 in. of land between the flats. The pins are also 3/32 in. in diameter. The bearinizing operation is also applied to the wristpin hole in the connecting rod and the piston and crankshaft holes in the crankcase, the latter being enlarged from 0.0005 to 0.0007 in. by this process. The finished hole is hard, smooth, and shows no perceptible variation from a true cylinder.

Welding in Maintenance

"Oxwelding for General Maintenance". 16 pp., illustrated, 8½x11 in. Published by The Linde Air Products Company, 30 East 42nd Street, New York, N. Y.

This booklet describes the use of the oxy-acetylene process of welding and cutting in reclamation of broken and worn machine parts, alteration, fabrication and installation of equipment. Among the various plant equipment covered are piping, tanks and containers, machine elements, engine and pump parts, frames and conveying equipment. Repair of worn parts by bronze-surfacing and hard-facing is given special consideration. Among the many illustrations is

a chart giving thirteen simple tests for identifying the more common metals.

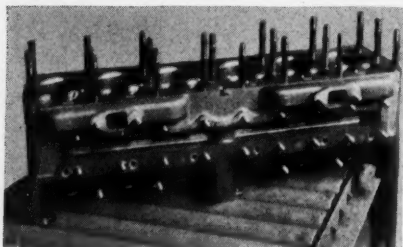
Bulletin of Firth-Sterling Products

The various kinds and grade of tool steels and stainless steels made by the Firth-Sterling Company, McKeesport, Pa., are described in a bulletin that has been issued by this firm. In addition to the well-known "Blue Chip" steel with which the trade has been familiar for several decades, the bulletin lists and describes Cromovan Triple Die Steel, Invar Oil-Hardening Steel for precision tools, cutter, gages, and so on, Tungsten Hot-Work Steels, C.X.W. Choice Steel for dies that are to be worked under great stress and heat, and other steels.

Finishing Cylinder Blocks for "White" Motors

By FRED B. JACOBS

PRESENT-DAY abrasive operations in the manufacture of automotive engine cylinder blocks at the plant of the White Motor Company, Cleveland, Ohio, are based upon the results of experimentation covering more than a quarter of a century devoted to the building of high class



Cylinder Block for White Engine.

motor vehicles. The first automobiles built by the White Company were of the "steam" variety. When the popularity of this type of engine waned, the company adopted the internal combustion type of engine and for many years built both passenger cars and trucks. Of late years, however, the company has devoted itself exclusively to the manufacture of trucks, buses, and like vehicles.

Motors for such heavy duty as the operation of these heavy units entails must be constructed with exceptional care, as they are subjected to severe operating strains. Again, the factor of accuracy is important, as accurate machining expedites assembly and assures the interchangeability of repair parts.

In the evolution of machining methods for automotive cylinder blocks, three methods of finishing the bores have been used. These methods, in the order in which they have served their purposes, are boring, grinding, and honing. The first cylinders finished by the White Company, as all other motor manufacturing companies, were bored to size. It was later discovered that a much finer finish and closer accuracy could be obtained by internal planetary grinding, and this method was adopted by practically all motor manufacturers. The present stage in the evolution of this operation was reached when it was found that an entirely satisfactory finish and the desired degree of accuracy could be obtained by using a hone. The hone, which consists primarily of a set of straight, narrow stones held in parallel, is revolved at high speed while being reciprocated in the bore of the cylinder. The use of the hone has made it possible to eliminate the cylinder grinding machine and thus speed up the production of cylinders.

A cylinder block for a White six-cylinder motor is shown in Fig. 1. The bores in this block are $3\frac{1}{2}$ in. diameter and $8\frac{3}{4}$ in. long. The boring operation is performed in a vertical boring machine that is fitted with six spindles. The boring bars run through bushings above and below the cylinder block and are thus held in alignment. It is practically impossible for the bars to be deflected by hard spots in the iron, if there are any, or by an uneven distribution of stock in the bore.

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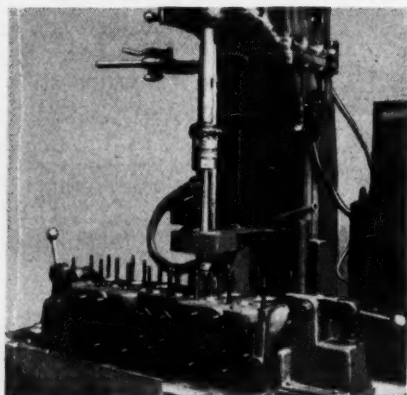
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MODERN TOOL WORKS

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Division of Consolidated Machine Tool Corporation of America

The cutting tools are of Stellite, which makes possible high speeds and heavy cuts. Each block is bored twice, the tools removing 0.250 in. in the first operation and 0.060 in. in the second. The bores are left 0.012 in. undersize, the bulk of this stock being removed by a reamer. The reamer leaves from 0.0015 to 0.002 in. of stock to be removed by the hone, all but 0.0005 in. of which is removed in



Cylinder Block in Position for Honing.
A Barnes Machine is Used, Equipped with a Hutto Grinder.

the rough honing operation. The remainder is honed out in the finish honing operation. The stones used in the finishing hones are of fine grain and leave a glass-smooth surface. It is customary to rough hone 30 or 40 blocks and then put them through the finish honing process.

In Fig. 2 is shown a cylinder block in position for honing. The machine is a Barnes vertical honing machine, fitted with a Hutto hone or "grinder." The cylinder block rests on three hardened and ground locating seats, where it is accurately positioned by the use of dowels which fit into holes in the bottom of the block. The block is held in position by quick-acting clamps at each end. The clamp consists of a swinging lever with a cam

handle, the cam being located so that it bears against an adjustable screw as shown in the illustration.

Although multiple spindle honing machines are often used for this operation, in the case under discussion single spindle machines are used. The chief argument for the single spindle machine is that each hole receives individual attention by the operator; thus none of the blocks require reworking due to undersize bores.

The honing head carries six 90-grit Carborundum stones. At the start of the honing operation, the operator lowers the honing head to about midway of the bore and then expands it to the diameter of the bore, which he notes. He then expands the head further to remove a predetermined amount of stock. The hone makes 60 strokes a minute vertically and revolves at a speed of 106 r. p. m. As each bar is finished in turn, the fixture is moved along to bring the succeeding hole into alignment with the spindle. A space bar locates the fixture properly and instantaneously for each hole.

To assist in the cutting operation of the hone, and to keep the stone and work free from the grit that is removed from the work by the stones, a stream of kerosene is kept flowing into the bore and over the head. The kerosene is filtered as it flows back into the supply tank.

In considering the use of the hone for the finishing of holes it must be remembered that the hone is a finishing tool, not a stock-removing tool. If the holes are bored or reamed out of alignment, no amount of honing will correct the evil. The hone is attached to the spindle by a universal joint; thus all it can do is to follow the course set for it by the boring tool. The hone removes only enough stock to take out the marks left by the boring and reaming tools, but in so doing it adds probably 5,000 miles to

the life of the finished motor. Where the preliminary machining has been properly done, cylinder bores can be honed to within 0.0001 in. plus or minus by using due care, although such close limits are seldom specified.

Spacing of Saw Teeth For Cutting Metal

THE number of teeth per inch on a metal saw is a point upon which all users do not agree, due to the fact that there are so many conditions covering each particular case.

From the standpoint of maximum efficiency, the size of the stock and the rate of feed to be maintained practically control the tooth spacing and also, to a large extent, the thickness of the saw. The larger the cut to be made, the larger the amount of chips that has to be carried through the cut; consequently there must be gullet room enough to carry free and not wedge in the gullet, or the result will be a broken tooth and frequently a broken plate as the tooth is likely to stick in the cut.

The heavier the feed to be maintained, the more chips each tooth has to care for, consequently wider spacing is necessary. Soft stock of perhaps 45 carbon or less should be cut with a saw having a coarser tooth than would be necessary on higher carbon and high speed steels, for the reason that the former can be cut more rapidly than the latter and more space is required for chips. The thickness of the plate should be the same where each kind is cut at a maximum rate of production.

A coarse-tooth saw on soft and annealed steels cuts more freely, and less cutting is required to saw off a bar for the reason that each tooth takes a large, deep chip, whereas on a finer-tooth saw the teeth have a

tendency to slide over the surface. Saws with coarse teeth should be used wherever possible; less friction is generated, leaving the saw much cooler and allowing it to do more work between sharpenings. Also less power is required to drive the saw. The coarse teeth are much stronger and allow more room in the gullets for chips. The increase in the strength of the teeth is much greater in proportion than the increase in the amount of work done by each tooth. The relation of the pitch, or distance from point to point of the teeth, to the thickness of the saw, depends entirely upon the kind of material to be cut and the conditions under which the cutting is done.

(From "Methods of Cutting Metals", published by Simonds Saw & Steel Co., Fitchburg, Mass.)

If a machine insists on chattering while a cut is being taken with a boring tool, try boring with the tool set upside down at the opposite end of the hole. The pressure of the boring tool will tend to hold the spindle down instead of raising it. This suggestion applies also to forming tool operations.

"Logan" Catalog No. AH30

Catalog No. AH30, describing and illustrating the chucks, cylinders, valves, and power devices for hydraulic operation made by The Logansport Machine Co., Logansport, Ind., is now ready for distribution. The catalog contains 52 pages of descriptions and information regarding equipment for use in connection with the electric hydraulic power device, and should serve as a handbook to designing engineers, chief engineers, tool engineers, and others who are interested in the tooling or equipping of machines. Copies gratis to engineers and mechanical executives.

Trial Grinding Wheels

By J. B. FREDERICK

WHEN a grinding wheel manufacturer decides to invade a new territory, or to gain new customers in an established territory, there is only one means open for introducing his product and that is to submit his wheels on a trial basis. The number of grinding wheels sold annually in the United States on a trial basis represents a substantial fortune in dollars and cents. As a matter of fact this problem is often termed the "trial wheel evil" by grinding wheel consumers. Evil or not, the practice must continue. The grinding wheel maker who is not willing to submit wheels on a trial basis will not increase his business substantially. On the other hand, the manufacturer who will not test new materials from time to time is sure to find himself a loser in the production race. Grinding wheels are, of course, used for thousands of purposes, but this article is devoted only to wheels used for rough grinding.

A persistent salesman can almost always secure an order for trial grinding wheels and in some instances the results are unexpected. I recall one instance wherein a purchasing agent in desperation gave a salesman a trial order for three wheels just to get rid of him. The wheels were to be used for grinding flashes from steel drop forgings. The wheels were delivered in due time, but were allowed to lie forgotten in the stock room for several months. One day the grinding room foreman ran short of wheels and the trial wheels were put into service. They proved so far superior in cutting and lasting qualities to the wheels previously used that there was no doubt of their value. The wheel manufacturer received a telegraph order

for several dozen more wheels to be delivered at once.

The foregoing instance is, of course, an unusual experience. Generally the results derived from different makes of wheels are so nearly alike that the better wheels cannot be picked out by rule-of-thumb methods. These inefficient trial methods really constitute the trial wheel evil. That is to say, a manufacturer will consent to ordering trial wheels, but he neglects to keep an accurate record of their performance. Thus when the salesman calls again to get the results of the test he may be told that his wheels are all right, but not quite as good or any better than the ones in regular use.

I recall another incident wherein a salesman submitted three carbide-of-silicon wheels to be used for snagging gray iron castings. In the meanwhile the cleaning room foreman was using manufactured alumina wheels in large quantities. In due time the salesman came back to get his report. Imagine his astonishment when he was informed that his wheels were no good would not cut, glazed, and so on. The salesman was not content with this report because he knew, as does anyone else who has investigated grinding wheel action, that there is no known abrasive that will grind cast iron more efficiently than carbide of silicon. He asked to see a sample of the work, and was given a small piece which he took to a metallurgical engineer for analysis. The material proved to be semi-steel. No wonder the carbide-of-silicon wheels did not grind it efficiently. In this case, if the salesman had been given authentic data at the start, much time and trouble would have been saved.



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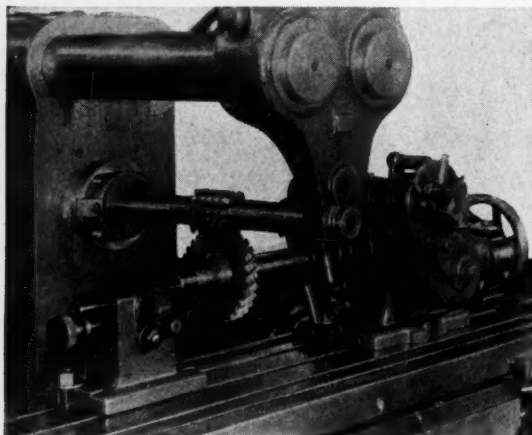
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IDEAS FROM READERS

Finish Hobbing in the Milling Machine

BY JOHN McCULLAGH

VERY few machinists know that one of the best ways to finish a wormwheel is by the free-driving method, for which it is not necessary



Milling Machine Set Up to Finish Hob a Wormwheel.

to coordinate the drive between the hob and the wormwheel. Liberally, the operation could be termed "free wheeling," inasmuch as the hob only is driven and—being meshed with the wormwheel—drives it just the same as a worm would.

A set-up of this kind is shown in the illustration. The wormwheel is mounted between centers, which in this case happen to be in a dividing head and tailstock. These accessories are usually available in every shop. In the case illustrated the set-up was

used for rough milling the teeth, which was accomplished by swiveling the table to the correct angle and using a single gear-tooth cutter.

The wormwheel, being free to rotate, is meshed with the hob, which is mounted on the cutter arbor. When the spindle is rotated, the hob drives the wormwheel. By feeding the knee of the machine upward, the hob will cut its way into the wormwheel and thus hob uniform, concentric teeth.

Where this method is best applied is in the construction of special machinery employing worm gearing that must be accurate. Assuming that the drive is "tight" and that a slight amount must be taken off the wormwheel, the final fit can be completed quickly by this form of set-up. Sometimes it is only necessary to mesh the wormwheel and hob to the correct center distance, and then "run them in" for two or three minutes. The hob will remove all high spots and the result will be a perfect wormwheel. The stock removed will be in the form of powder, but usually it is these slight irregularities that cause gears to heat while in use.

Unfortunately this method will not act as a "putting-on tool", so that it is well to leave a little on to be hobbled off rather than take off too much when rough milling.

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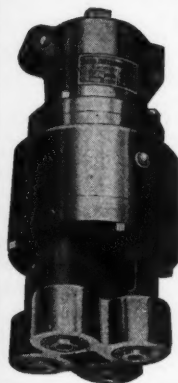
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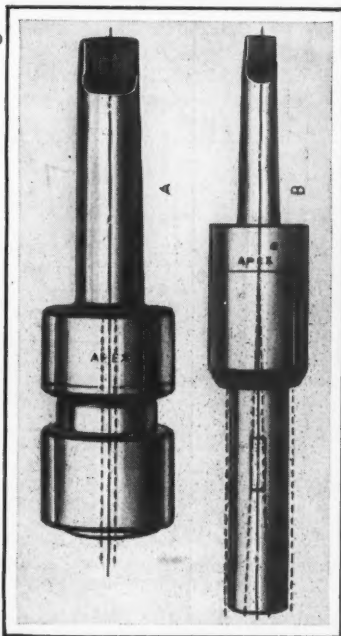
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Tools for Corrugating Copper Sheets

By WILLIAM ANDERSON

FOR experimental purposes it was necessary to corrugate twelve sections of sheet copper, each $1/16$ in. thick, 6 in. wide, and 6 ft. long as

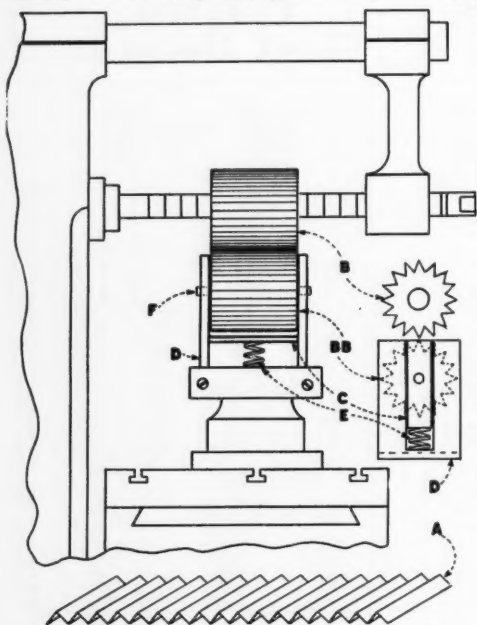


Diagram Illustrating Method of Corrugating Copper Sheets in the Milling Machine.

indicated at A in the illustration. As a repeat order for this job was improbable, the job was to be done in the cheapest manner possible and the cost of whatever tools were used was to be kept at the minimum. By using the method described here the cost of the tools was kept below the estimate and the job was turned out in a satisfactory manner.

Two forming gears were made, the teeth being flat on the sides so that the two gears would mesh perfectly. One of the gears was placed on the

arbor of a milling machine as shown at B, and the other, indicated as BB, was drilled through the axis for a pin F, which was held in a U-shaped bracket C. The bracket C was located in slots in the end pieces D, where it was free to move vertically. The end pieces D were held in a vise on the table of the milling machine, as shown. A heavy coil spring E was located under the cross piece of the sliding bracket C, the tension of the spring tending to force the bracket upward and maintain the lower gear in mesh with the upper one. The device was tried without the spring, but results were unsatisfactory.

With the gears in mesh and ready for operation, the machine was started and a copper sheet was fed into the gears. As soon as it protruded from the opposite side sufficiently, the end of the sheet was grasped with a pair of pliers, and the sheet was guided through the gears by hand. A perfect job was produced with this equipment at very small cost.

Grinding Radii on Die Sections

By F. J. WILHELM

THE illustrations show how we ground the radii on two sections of a large sectional die that was made in our shop recently. The die is shown in Fig. 1, and the two pieces upon which the radii were ground can easily be identified. Both edges and the radius on each piece were ground at a single setting, using an index head, chuck, and stud as shown in Fig. 2. The work-piece, A, was soldered to the stud B, and the stud was held vertically in the chuck so as to bring the surface to be finished at right

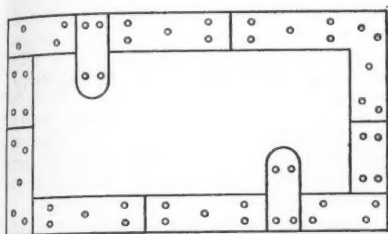


Fig. 1—Plan drawing of sectional die, showing radial sections.

angles to the side of the grinding wheel, indicated as C.

It is just as easy, however, to use the face of the grinding wheel, which can be done by setting up the index head so that the stud will be held horizontally, as shown in Fig. 3. If it is permissible to drill a small hole in the die-section, the piece can be held by the use of a threaded stud and nut, or the hole in the work-piece can be tapped and the stud screwed in. By grinding the edges and radius in this manner, perfect concentricity of the radius with the sides is assured at all times, regardless of the amount of stock removed.

Taking Proper Care of Gage Blocks

By W. F. JAMES

PRECISION gage blocks, while expensive, are necessary in these days when measurements are made in ten-thousandths of an inch but unless they are handled and guarded with the proper care, they soon lose their value as the precision reference blocks for which they were intended.

With the right kind of care, precision gage blocks can be used almost indefinitely without appreciable wear. But the point must not be overlooked

that any wear, however slight, is bound to make a difference and this difference is multiplied several times when several blocks are wrung together. Here are some suggestions as to the care of gage blocks.

Gage blocks should not be used near a grinding machine, as the abrasive dust is hard to remove from all surfaces of the blocks.

Blocks should be wiped clean before using, using first a chamois and then a clean sheet of soft paper. The paper should be taken either from a tablet or from a roll, in which form no dust can settle on the sheets. Clean

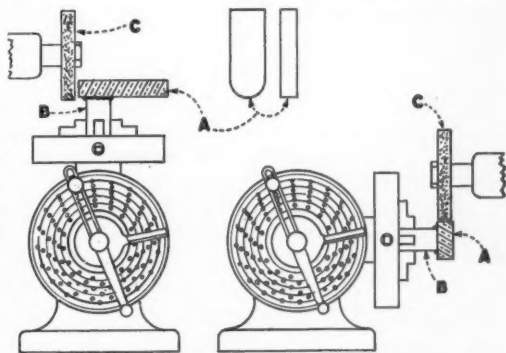


Fig. 2 (Left)—Drawing showing set-up that was used to grind radii on die sections. Fig. 3 (Right)—By using this set-up, the face of the grinding wheel can be used.

paper is the one material which will leave neither dust, lint, nor oil, and should be used to clean precision surfaces.

Before using a gage block to test the width of a slot that is being lapped to precision measurements, the slot should be cleaned with gasoline and then wiped dry, first with cloth and then with soft paper.

Gage blocks should never be swiveled in a slot while testing, as the swiveling movement will soon wear a gage block undersize.

Gage blocks should never be used near soldering operations, as the

fumes produced by the action of the acid will cause a fine coating of rust on the blocks. This applies also to other operations where acid fumes are prevalent.

Before gage blocks are returned to the case to be put away, they should be wiped clean either with a chamois or with clean, soft paper, and should be deposited in their places without being touched by the naked hand. It is impossible to wash hands so clean that a certain amount of perspiration or oil from the skin will not be deposited on the surface of the block, and if the blocks are undisturbed long enough, rust will form where the block was held by the fingers.

By these three signs shall ye know the incompetent mechanic: clamping a mic or vernier on the work and then pulling it off, using gage blocks in close proximity to a surface grinding machine, or pounding work while it is on the surface plate.

Bulletin of "Nolap" Abrasive Sleeves and Expanding Polishing Wheels

Faster polishing with less labor, cleaner work, and the absence of expensive setting-up costs are salient features of "Nolap" Abrasive Sleeves and Expanding Polishing Wheels, described in a bulletin that is being issued by The Cleveland Container Co., Abrasive Division, 10630 Berea Road, Cleveland, Ohio.

The "Nolap" Abrasive Sleeve is an endless band of strong cloth backing, coated with abrasive material and made to fit over a heat-resisting rubber filler that is held between two carefully-balanced aluminum alloy flanges. As the flanges are brought together by tightening a threaded collar, the rubber filler expands to hold the band in a vise-like grip. The sleeves are available in all abrasive materials and in all grits commonly used.

The operation of "setting up" is done

away with entirely, and there is no need to hammer the wheel to insure proper cutting conditions. The wheel is in perfect running balance at all times, eliminating necessity for balancing. As it is unnecessary to dry the wheels before using, the wheel inventory is reduced. The changing of a sleeve requires less than two minutes, and the use of glue and loose abrasive is done away with.

Copies of the bulletin can be had by addressing the firm as above.

Landis Universal Grinder Catalog No. L-33

Catalog No. L-33, issued by Landis Tool Company, Waynesboro, Pa., is devoted exclusively to description and illustrations pertaining to the Landis 14-in. Type C Hydraulic Universal Grinding Machine. The machine under discussion was designed to fill the demand for a "manufacturing universal grinder", and the text is presented in such manner as to answer the questions that will logically arise in the mind of a prospective purchaser of such a machine.

The items of flexibility, production speeds, accuracy, weight, universal features, accessibility, hydraulic system, bed, carriage, grinding wheel head, grinding wheel spindle, headstock, oil pump, and other features of the machine are discussed in order, and illustrations are included to aid the reader to obtain a clear idea of the construction of the machine and its possibilities. A table of specifications gives dimensions. Copies gratis to mechanical executives.

"The Biax Setter"

A bulletin describing and illustrating the Biax Screw and Nut Setter has been issued by The Charles L. Jarvis Co., Gildersleeve, Conn. Three types of setters are illustrated; the single drive overhead unit for production work, the double drive overhead unit for use where two sizes of screws or nuts are to be driven by the same operator, and the roller floor type unit for general shop use. Drawings of the various types of screw driver bits, guides, and socket wrenches for use with the setters are included, together with descriptions. Copies can be had upon request.

July, 1933

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MODERN MACHINE SHOP 25

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Over the Editor's Desk

Are You Ready?

INDUSTRY, today, is practically a gigantic jig-saw puzzle in which, as the various units come to life and re-group themselves, new opportunities will become visible. Organizations that once functioned in harmony and accord have disintegrated and the individuals have drifted in all directions. Mechanics who worked side by side at the bench or machine have been led by their quest for a livelihood into distant places and into new lines of work which, for many of them, will be permanent. Men who held responsible executive positions in former years have drifted into other industries or businesses where they perhaps feel more secure and in which they will remain, or have been relegated to subordinate positions from which they may not emerge again.

As the economic atmosphere clears and the sunshine of a new prosperity breaks through the clouds, it will be found that many units—both large and small—which flourished in former years have crumbled and passed into history. On the other hand there will be just as many or more which, guided by capable and far-seeing managers, have taken advantage of the situation to entrench themselves more firmly than before and have assumed positions of new importance in their respective fields. Added to these are a vast number of new industrial and commercial units, born of hope and nourished by necessity, which have found opportunities for service and have made places for themselves in the new set-up.

As the demand for raw and finished materials increases and the wheels of industry gather momentum, organizations will begin to reshape themselves and a demand will be created for executive ability. New leaders must be

found to take the places left vacant by those who have drifted into other fields, and new positions of leadership will be created for which capable candidates must be found.

The day of opportunity is not past; it will **never** be past. Opportunity is legion, and it returns periodically in greater number and with greater possibilities than ever before for those who are prepared to recognize it.

We are entering upon a new economic cycle; one in which opportunities for better jobs and greater remuneration will be present in abundance. But those opportunities will be visible only to the person who has prepared himself for advancement through making the most of whatever job he had, or who has added to his capabilities and widened his range of vision by burning the midnight oil. Preparedness is the watchword of the day.

Business Straws

THE American Federation of Labor, through its president, William Green, estimates that more than 1,200,000 persons have gone back to work since March.

Electric power output is 10 per cent greater than at this time last year.

Steel operations have risen to 50 per cent of capacity for the first time since 1931.

Sales of automobiles have increased to a point that is surprising the industry itself.

It is estimated that the Administration's public works program will put 6,000,000 men to work by the first of the year.

Reports are being received daily announcing wage and salary increases in the automobile industries, textile industries, and many other industrial and commercial units.

NEW SHOP EQUIPMENT

Ex-Cell-O Junior Precision Boring Machine

TWO new models of the Ex-Cell-O Precision Boring Machine, consisting of single and double end machines designed for short production, high precision work on automotive parts, refrigeration unit parts, and so on, have been developed by Ex-Cell-O Aircraft & Tool Corporation, 1270 Oakman Blvd., Detroit, Michigan.

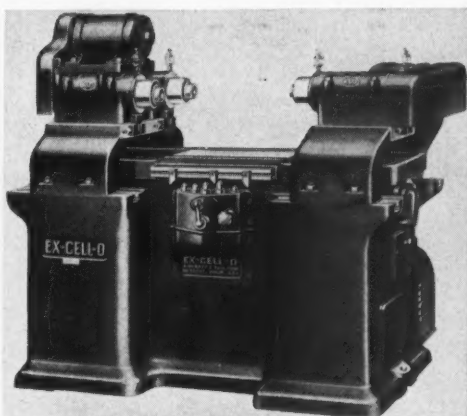
The features of the double end machine, known as the No. 1212, are: compact design, low operating cost, full hydraulic control, uniform accuracy on production work, and facilities for both rough and finish operations on the same machine for aluminum, bronze, cast iron, and steel parts.

The base of the machine is rugged, with heavy walls and cross ribbing. A bridge at each end of the machine provides for the mounting of either one or two boring units. In the illustration, two boring units with a drive motor mounted above them are shown at the left and one boring unit with motor mounted beside it is shown at the right. The type and number of boring units used depends upon the individual application. Each bridge is adjustable on its own rails, providing a maximum distance of 28 in. between boring units and a minimum distance of 12 inches.

The boring units can be driven by either of two methods—the inbuilt motor or the belt drive. For the former, a $\frac{3}{4}$ h.p. motor rated at 1800 or 3600 r.p.m. is used, providing only one speed. Where a range of speeds is required, the belt-driven unit is used and a 1 h.p., 1200 r.p.m. motor may be mounted beside the boring unit or directly above it, depending upon the number of units used.

The fixture table is provided with a finished pad, 12x22 in., for holding the work fixture and rides on one vee and one flat way, both of which are lubricated from the hydraulic pressure system. Large water channels and a drain chute with filter basket for the coolant are also provided.

At the rear, near the bottom of the machine and mounted in line, are the main drive motor and coolant and hydraulic pumps. The motor is $1\frac{1}{2}$ h.p., 3 phase, 220 or 440 volt, 60 cycle, 1200 r.p.m. The hydraulic control unit is of Ex-Cell-O design and is mounted on the front of the machine below the fixture table. Near the top of this unit is an



Ex-Cell-O Junior Double End Precision
Boring Machine

oval plate which can be removed for adjusting the rate of table feed in each direction. The oil is circulated through the hydraulic system under 100 lb. pressure. A control valve, operated by adjustable dogs on the table, provides for loading the fixture dry, and provision is made for shutting off the coolant while adjusting the machine.

The machine weighs approximately 3,000 lb. and the floor space required is $14\frac{1}{2}$ square feet.

For applications where only one or two boring units are required, the single end machine is adaptable. The machine is of extremely compact design, and the same mounting bridge, hydraulic and coolant systems are used on this machine as on the double end machine. This machine is also of heavy construction,



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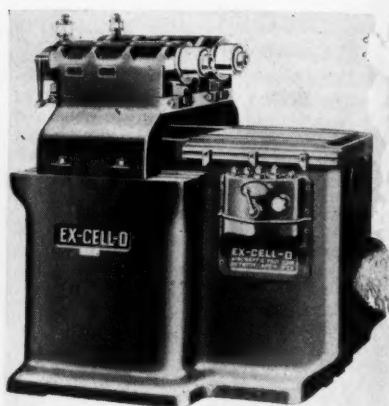
The Chas. L.
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"Manufacturers of Flexible Shaft Machinery
and Tapping Attachments"

and room is provided on the side at end of the machine so that the operator can operate the machine from either position.

The type of boring unit illustrated with this machine has an inbuilt motor



Ex-Cell-O Junior Single End Boring
Machine

directly connected to the boring spindle and mounted in one holding bracket. This unit and those shown on the double end machine are interchangeable by the use of the proper bridge.

To operate this machine, the adjustable dogs which operate the plungers on the top of the hydraulic unit are adjusted so that the high and low speeds, reverse and stop dogs conform with the required operating cycle. After these are set, the machine is started on its cycle by moving a hand lever. The table is automatically stopped at the end of the cycle. The stop can be controlled manually by moving the lever in the opposite direction. The table can be reversed during any part of its cycle, independently of the operating dogs.

Societe Genevoise Optical Gear Tester

An Optical Gear Tester, developed by The Societe Genevoise d'Instruments de Physique of Geneva, Switzerland, is now being marketed in this country by The R. Y. Ferner Co., Investment Bldg., Washington, D. C.

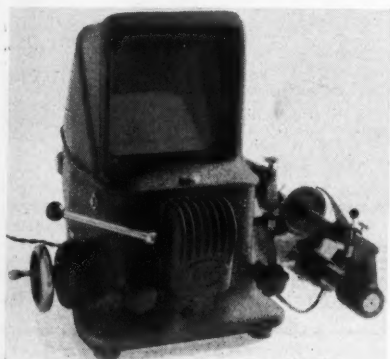
The tester differs from most projection instruments in that it does not project

an image of teeth of the gear, but throws on a graduated screen a rectangular shadow of a signal plate by which, on the horizontal ordinate of the screen, one reads the variations of eccentricity of the gears, and on the vertical ordinate, the errors of pitch. Other features of its design provide for very rapid operation of the apparatus; thus, it is essentially an instrument for rapid routine testing of gears.

The capacity of the gear tester is for gears up to a maximum of 4 in. diameter, and it is practicable to test gears as small as 0.16 in. diameter. Contact anvils with which to make settings in the teeth of the gears are regularly provided for modules of 0.5 to 2.0 mm. or for diametral pitches of approximately 50 to 12, and can be supplied for diametral pitches up to 100 or for a maximum diametral pitch 10. Direct readings of divisions of the

can be made to 0.0002 in. or estimated to 0.00005 in., the guaranteed accuracy being plus or minus 0.0001 inch.

The gears to be tested are mounted on mandrels between adjustable centers which are supported on a heavy cylinder. The position of the cylinder can be adjusted according to the diameter of the gear by rotation of a hand wheel, and a ratchet device makes it possible to step



Societe Genevoise Optical Gear Tester

the gear around a given number of teeth at a time.

A pair of interchangeable feelers serves to locate the gear for inspection. The upper feeler is fixed during the test and serves merely to index the gear, pitch measurements being made with the second feeler. The second feeler is carried on a floating arm which swivels to right and left and tilts vertically without play. The

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WALDRON *Laminated* **SILENT** STEEL *Gears*

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other end of this arm carries a rectangular steel "signal" plate about 0.005 in. thick, with edges lapped square to each other.

Two adjusting screws serve to hold the signal plate exactly in the focus of a microscope with objective of large aperture and a projection ocular. A condenser with 50-watt light behind it projects the shadow of the rectangular signal onto a mirror and thence to the screen. The mirror is optically flat, is silvered on its front surface and protected from oxidation.

The arm that carries the optical signal and the lower feeler, being moveable vertically, shows the variations in pitch. By

swinging the same arm to right or left, variations in eccentricity can be registered. Thus, with the same feeler, both points are checked simultaneously.

The time required to set the instrument for a new size of gear, including setting the scale to zero and making enough tests to check the setting, is two minutes, while the time required to change to another gear of the same size and re-set to zero is 30 seconds.

"Stackbin" Stacking Tray

The Stackbin Corporation, Providence, R. I., announces a stacking tray of a design that is intended to facilitate the storing of parts. The trays are identical in width, but the ends of each tray are so formed as to provide a guide or channel which serves to hold in alignment any tray which may be placed on it. Thus any number of trays can be stacked, one on another, without danger of a corner of one tray slipping inside the tray below and precipitating a whole stack. At the same time the guides make it possible to slide a tray sideways far enough



"Stackbin" Stacking Tray

so that parts can be inserted or removed.

The Stackbin stacking tray is made of heavy sheet steel, and all edges are substantially reinforced by being folded over; thus the tray is practically indestructible. The channels project at the

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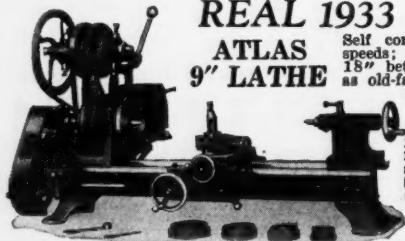
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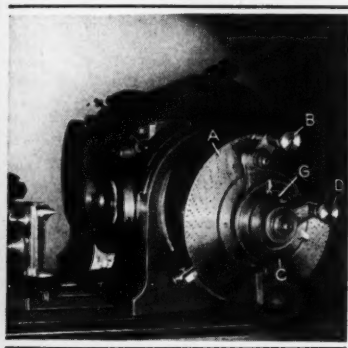
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ends of the tray in such manner as to form natural handles for grasping the tray. The tray is available in a wide variety of sizes, to meet various requirements.

Cincinnati Wide Range Divider

The Cincinnati Milling Machine Company, Cincinnati, Ohio, announces a "Wide Range Divider" for use with Cincinnati universal dividing heads for rapidly selecting divisions from 2 to 400,000 and any angle in degrees, minutes, and seconds. Any of the division or angles can be made or obtained with the dividing head spindle set at any angle from 10 degrees below the horizontal to 50



Cincinnati Dividing Head Equipped with Wide Range Divider

degrees beyond the vertical, as, for example, when cutting bevel gears. Spiral gears can also be indexed.

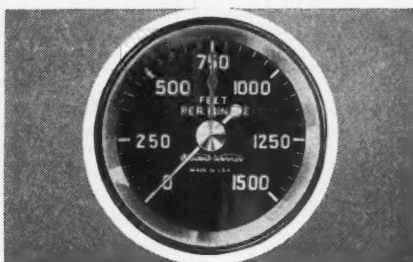
The arrangement comprises a compact, self-contained unit built into the dividing head, and consists of the large index plate A, sector and crank B, together with a small index plate C, and sector and crank D. The mechanism is so arranged that the small crank D operates through reduction gearing of 100 to 1 ratio enclosed in the housing G. The ratio between the dividing head worm shaft and spindle is 40 to 1.

The divider can be set up for universal indexing in the conventional manner by utilizing the crank B only, in combination with the proper hole circle on the large plate. The large plate is drilled on both sides and contains 11 hole circles on each side for taking care of the many divisions ordinarily obtained by universal

Control AT A GLANCE

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IN thousands of industries, these reliable instruments are guarding against high labor costs—waste of material—lowering of quality and machinery depreciation. They indicate machine speed—or, through special calibration, any machine unit of production desired.

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City State.....

indexing, the operation being the same as it has been heretofore on the standard Cincinnati universal dividing head.

When the number of divisions required cannot be obtained by the conventional indexing methods, as, for example, 67 divisions, then the "wide range divider" is employed. Any of the hole circles on the large plate can be used with the small plate, but by using the 100-hole circle, setting the sectors on both the large and small index plates A and C properly, and indexing both cranks B and D correctly, the 67 divisions may be obtained with an error of only 0.000094 in. on a 12-in. diameter circle.

Any desired angle in degrees, minutes, and seconds can be easily selected, the 54-hole circle in the large plate and the 100-hole circle in the small plate C being employed. One turn of the large crank B equals 9 deg., one space on the 54-hole circle equals 10 min., and one space on the small plate equals 0.1 min. or 6 seconds. Thus 10 spaces on the small plate equal 1 minute.

Cincinnati dividing heads in use in the field can be equipped with the wide range divider, and it is recommended that the fitting be done at the factory.

Greenfield "O. K. Jr." Tap and Die Sets

To meet the demand that has developed for an economically-priced screw plate, the Greenfield Tap and Die Corporation, Greenfield, Mass., has placed on the market the "O. K. Jr." line of round die screw plates. The new line consists of twenty different sets of commonly-used taps and dies in size ranges from 4-36 to 12-24, in the machine screw sizes, and from $\frac{1}{8}$ in. to $\frac{3}{4}$ in. in the fractional sizes.

One of the most popular sets in the line is the No. 3100 Automobile Set, shown in the illustration. This set contains eleven dies, to cut sizes from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. NC and NF threads and $\frac{1}{8}$ in. pipe size, with a tap for each die. A three-screw die stock is provided to hold the dies, and a tap wrench is provided which will hold any of the taps in the set. A bit-brace die holder is also included, making it possible for the mechanic to use dies to dress over bruised or battered threads in close quarters.

Other sets with other combinations of sizes are available. All sets are packed in nicely-finished hardwood boxes which

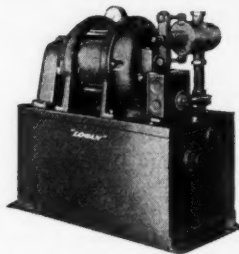


Greenfield "O. K. Jr." No. 3100 Die Set

are intended to serve as permanent cases for the tools.

"Logan" Improved Electric-Hydraulic Power Unit

An improved Electric-Hydraulic Power Unit has been developed by The Logansport Machine Co., Logansport, Indiana.



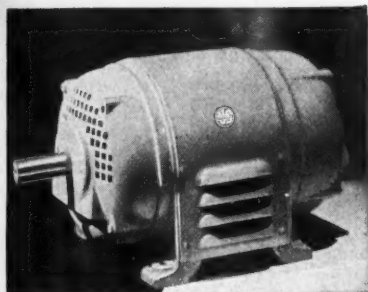
"Logan" Improved Electric-Hydraulic Power Unit

This unit is especially designed to facilitate the operation of chucks, work-holding fixtures, clamps, holsts, and in conjunction with any type of machine shop equipment on which such devices are used. The unit is of the accumulator constant-delivery, variable-pressure type. Pressure available is from 50 lb. to 200 lbs., adjustable through a regulating valve.

U. S. Doublenclosed Explosion-Proof Motor

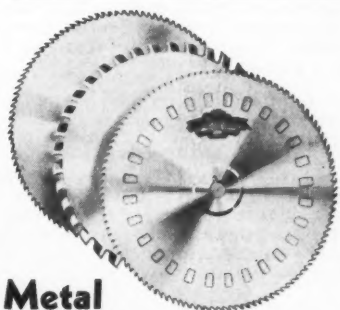
For use in locations where dust, dirt, moisture, acid fumes, or elements are more than ordinarily detrimental to the mechanism of a motor, or where such dust or fumes form an explosion-hazard, the U. S. Electrical Mfg. Co., 200 East Slauson Ave., Los Angeles, Cal., has developed the motor shown in the illustration. This motor, called the U. S. Doublenclosed Explosion-Proof Motor is furnished in the Type SD, for explosive dust conditions or in Type SE, which is intended for use where explosive inflammable gas is present.

The Doublenclosed motor has two enclosing frames with an unusually large



U. S. Doublenclosed Explosion-Proof Motor

fan mounted between the frames. The inner frame completely encloses the electrical windings, stator, rotor, anti-friction bearings and bearing chambers, sealing these vital parts against the intrusion of deteriorating substances. The outer frame completely covers and protects the whole unit. Dust, fumes, and foreign matter are air-blasted away from the air passages between the inner shell and outer frame. Both types of the Doublenclosed motor are provided with asbestos-protected windings, the winding being insulated with asbestos and electrically impregnated with Asbestosite. The rotor is of die-cast aluminum, in one piece, with bars and end rings one homogeneous mass of metal. The inner shell is of cast steel. The bearing support has an extra long sleeve bushing of graphite bronze which is self-lubricating. The elongation of this bearing support impedes the travel of explosive gases. The terminal chamber is of cast metal, machine-fitted



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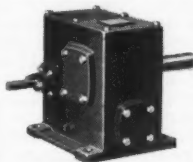
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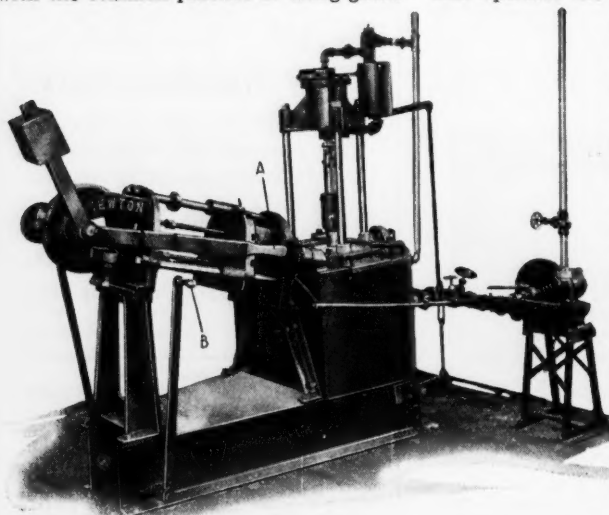
to the motor frame. The anti-friction bearings are grease-packed and sealed within a liberally-proportioned labyrinth chamber. Lubrication is required but once a year.

Newton—New Haven Die-Casting Machine

Newton-New Haven Company, of New Haven, Conn. has recently introduced three radically new types of die casting machines designed and built to compete with the common practice of using gated

lions of castings has proved to be the most practical injection method.

One of these new die casters is hand operated, another is semi-automatic and the third is full-automatic. On both the hand and semi-automatic types there are but two levers used when machines are in operation; on the full-automatic there is only one. The semi-automatic machine here illustrated, plainly shows the two controls. Lever A is raised or lowered to open or shut the die, lever B is moved to the left to make a "shot", and is returned by a spring which at the same time operates the air valves to raise the



Newton-New Haven Semi-Automatic Die Casting Machine

patterns and sand casting for non-ferrous alloys. The new machines are particularly advantageous for short runs of widely diversified castings, although they are equally effective for continuous operation when thousands of duplicate castings are required. Like standard machine tools, the Newton-New Haven Casting Machines are "universal" in character. They can be quickly changed from job to job or set up for long production periods. Their simplicity eliminates both expensive tooling and the necessity of employing highly skilled casting machine operators.

In one respect the Newton-New Haven Die Casting Machines are similar to equipment used by commercial die casters; they employ the positive plunger injection principle which years of commercial die casting experience with mil-

lions of castings has proved to be the most practical injection method. One of these new die casters is hand operated, another is semi-automatic and the third is full-automatic. On both the hand and semi-automatic types there are but two levers used when machines are in operation; on the full-automatic there is only one. The semi-automatic machine here illustrated, plainly shows the two controls. Lever A is raised or lowered to open or shut the die, lever B is moved to the left to make a "shot", and is returned by a spring which at the same time operates the air valves to raise the injector plunger to self-loading position. Casting speed is thus limited only to the speed of the operator and can run as high as 400 to 500 shots an hour on short runs, or 600 to 700 shots an hour on continuous production runs. With the hand machine, production rates are somewhat lower and with the full-automatic the rates are considerably higher. Multiple impression dies boost the number of pieces per hour in direct proportion to the number of impressions.

Mechanically, these machines are modern in every respect. All major castings are of steel and all other stressed members are of heavy rolled steel shapes or forgings. Welding is freely used for permanence of construction. The furnace has a welded steel plate shell lined first with one of the most efficient insulations known and then with a non-shrinking, low expansion coefficient monolithic refractory heavily insulated against heat loss and fully protected against exterior damage. In the hand and semi-automatic models the dies are quickly closed with high pressure by hand but without exertion by the operator. In the full-automatic type, die closing is electric motor-driven by clutch and safety tripers. In the semi-automatic model the injector plunger is operated by a specially designed cylinder which uses but one charge of air at 100 lbs. pressure for both injection and plunger return. Interlocks on all machines prevent casting

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shots from being made before dies are locked in closed position.

Another economy feature is in the low tooling costs for these machines. Although all three machines will take dies up to 9x12x9½ in. deep, much smaller dies can be used and a proportional die cost saving can be made. For short runs, the low costs of the single impression dies which can be used on these machines bring casting costs down abruptly. For long runs, or where short runs warrant, multiple impression dies can be used to even further increase the high production economies which are readily obtained. And since any complete change of dies regardless of size can be made within 20 minutes or less, it is practical to use this machine for a wide diversity of castings. No matter how it is used the fixed charges against one of these machines can be either divided between a great number of similar pieces or a large total for a smaller number of pieces of dissimilar jobs. This is distinctly a unique feature of Newton-New Haven Die Casting Machines.

One other point of these new casting machines is quite important from a purchaser's standpoint. With the exception of the dies, each machine is shipped complete, ready to run. Standard equipment includes furnace, chassis, gas firing equipment, pyrometer, die clamps, integral ejectors, Zerk lubrication and all other parts essential to immediate operation to full capacity.

Carboloy "Grade 300" Truing Tool

Supplementing the present two grades of diamond-impregnated wheel truing tools made by Carboloy Company, Inc., 2485 East Grand Blvd., Detroit, Michigan, this firm has brought out the "Grade 300" truing tool. The Grade 300 tool contains the best quality of stones to accommodate the more difficult dressing jobs.

A further development is the sub-division of each of the three grades into three groups based on the mesh size of the diamond particles used. These are classified as follows:

Mesh size of stones:	Fine	Medium	Coarse
Grade 100:	101	102	103
Grade 200:	201	202	203
Grade 300:	301	302	303

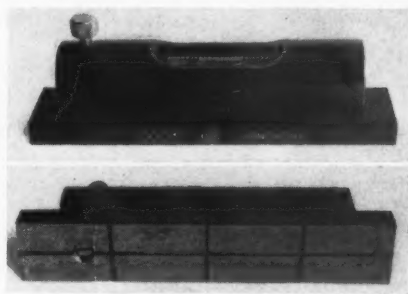
This choice of mesh sizes considerably increases the range of work which can be done by any one particular grade and in many cases enables the user to successfully use a lower-priced grade than would be possible were only one mesh size available. Similarly, the three grades of stones now available offer

opportunities for economies as the user may select the exact grade most suitable for his work, eliminating the necessity of purchasing more expensive stones when less costly ones will do the job satisfactorily.

The Grade 300 tool, similar to the others made by the Carboloy Company, consists of an extremely hard matrix—next to the diamond itself in hardness—throughout which a quantity of diamond particles have been distributed, providing a multiplicity of sharp cutting points at each new surface reached. No re-mounting or other maintenance is required throughout the life of the tool.

Societe Genevoise Precision Level

Through their American agents, The R. Y. Ferner Co., Investment Bldg., Washington, D. C., the Societe Genevoise d'Instruments de Physique is placing on



Societe Genevoise Precision Level the market a high precision level which is particularly adapted for shop use, for checking the accuracy of machine tools and high speed transmissions, setting sine bars on inclined surfaces, leveling base plates and beds, and for manufacturing all kinds of tools and fixtures.

The body of the level is of hard steel, machined from the solid so that it is insensitive to shocks and protects the level vial against temperature variations and hand heat. The base is carefully scraped and is provided with cleaning grooves. The length of the base is 6½ in., and its width is 1½ in. The finish is black enamel.

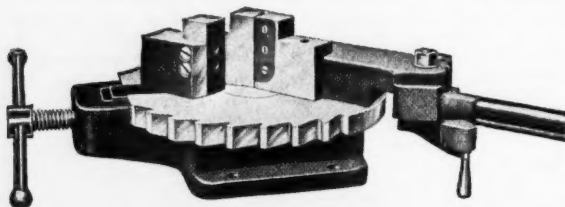
The level vial is cemented in a brass mounting which is adjustable by means of a knurled screw. This permits setting the vial zero and also permits setting the level for slightly tilted surfaces, which is often desirable in checking the ways of machine tools that are not exactly level.

It also permits measurement of progressive tilts that overreach the graduation of the vial.

The spacing of the vial divisions is about 0.1 in. and there are four divisions each side of zero so that the total capacity is 40 seconds of arc. The level can be furnished with or without a wood case. The net weight of the level is 2.1 pounds.

Sampson Universal Bending Machine

A machine that will bend flats, rounds, angles, squares, tees, profile iron, or tubing, either hot or cold, up to the size listed below, has been brought out by the



Sampson Universal Bending Machine

Sampson Tool Co., Inc., 101 Walker St., New York, N. Y. Any of these shapes can be bent to any desired angle up to 60 degrees.

	COLD	HOT
Flat bars...	$2\frac{1}{2} \times \frac{1}{8}$, $3\frac{1}{2} \times \frac{1}{4}$, $4 \times \frac{1}{2}$	$3\frac{1}{2} \times \frac{5}{8}$
Rounds	$\frac{3}{8}$	$1\frac{1}{8}$
Squares	$\frac{3}{8}$	$1\frac{1}{8}$
Angles	$2\frac{3}{4} \times \frac{1}{4}$	$3\frac{1}{2} \times \frac{5}{8}$
Tees	$1\frac{1}{2} \times \frac{1}{4}$	
Tubing, up to....	$\frac{3}{4}$	1

For the bending of squares, angles, or tees at round, obtuse, or acute angles, special dies are provided with which the

machine can be equipped very quickly. The normal bending block is fitted by four strong setscrews, and eight different positions can be obtained. It is thus possible to bend shapes and squares of every size down to $1\frac{3}{4}$ in. length of side.

The machine is operated by means of a short hand lever and ratchet, but can be used without the ratchet when bending light gauge materials. The construction is of the simplest and the machine can be operated by unskilled workmen.

New Electrode Welds Cromansil Steel

Two additions to the Murex line of heavy mineral coated arc welding electrodes are announced by the Metal & Thermit Corporation, 120 Broadway, New York.

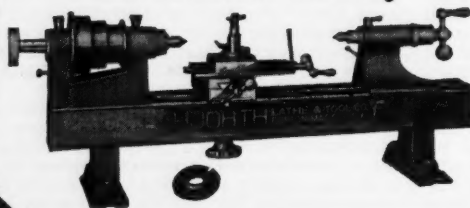
One is a special electrode designed for welding Cromansil Steel, a new development in high strength steels having a tensile strength of 80,000 to 100,000 lbs. per sq. in. along with high ductility.

The new electrode gives a deposit of the same analysis as Cromansil. The weld metal has physical properties which are equal to the parent metal in every respect.

The second addition to the Murex line is an electrode which deposits a metal containing 4 per cent to 6 per cent Chrome and .5 per cent Molybdenum. It is specially suited to the welding of petroleum refinery equipment where metal of this type is used extensively.

Further particulars on these two products may be had by writing the Metal & Thermit Corporation at the address given above.

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That is what scores of Hjorth Bench Lathe users tell us. It gives you speed, accuracy, long service and satisfaction. Catalog illustrates details. Write for it.

HJORTH LATHE & TOOL COMPANY
60 State St., Boston, Mass.

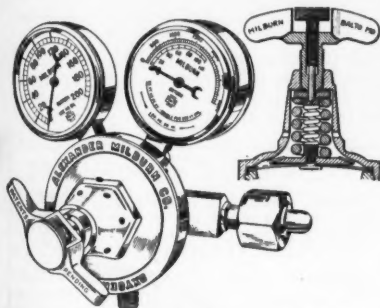
Milburn Micrometer Adjustment Regulator

A dual adjustment comprising a fine micrometer adjusting key housed within and operating separately from the main regulator key is the feature of a regulator which has been developed by The Alexander Milburn Company, 1420 W. Baltimore St., Baltimore, Md., for use with oxygen, acetylene, and other gases.

The regulator has two compression springs, one within the other, operating a removable, non-corrosive metal diaphragm. The main key operates the standard or heavy spring, and the micrometer adjustment key operates a fine bronze spring which enables the operator to secure a range of from zero to approximately five pounds, in addition to the adjustment obtained with the standard adjustment key.

This means of adjustment is so fine that fractions of an ounce can be obtained with the micrometer key, either when the pressure is set at zero or at whatever pressure the standard key has been set for on the regulator. The regulator is extremely sensitive for the finer pressures necessary for low pressure torches and small torches doing fine work and requiring close adjustment. It is especially applicable for torches working on aluminum, airplane parts, fine experimental work, and so on.

The design of the micrometer key housed within the standard regulator



Milburn Micrometer Adjustment Regulator

key is strong, simple, and effective and is so standardized as to be quickly applied to the standard Milburn regulators.

The only additions are a new key, button, and bronze tension spring.

Van Keuren Flatness Tester

A flatness measuring instrument designed to give the same precision in measuring machined, ground, scraped or dull lapped surfaces as is obtainable with the optical flat on highly finished steel surfaces is being introduced by The Van Keuren Co., 12 Copeland St., Watertown, Mass.



Van Keuren Flatness Tester

The instrument as shown consists of a channel supporting a cylindrical contact at one end, a micrometer with a spherical contact at the other end, and a very sensitive light wave indicator with a spherical contact in the center. Means are provided for changing the positions of all three contacts to accommodate different surfaces such as flat ring shaped



Faster-Easier

Stanley Electric Hammers take the hard work out of drilling holes in concrete, brick and stone. Use them to speed up the installation of machinery, hangers, etc.

The hammer illustrated weighs only 10 pounds and shoots holes like nobody's business.

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THE STANLEY ELECTRIC TOOL CO.

New Britain, Connecticut

laps, surface plates, and machine ways. Special auxiliary flat contacts are provided for testing machined or scraped surfaces in order to avoid local hollow spots.

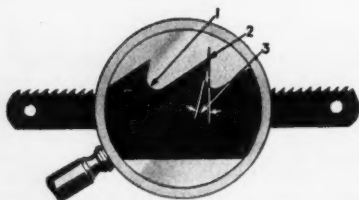
In operation, the micrometer end of the instrument is lowered until a very slight movement of the interference bands on the indicator shows contact of the center point with the surface being tested. The micrometer reading then shows the exact amount the surface is convex or concave, after a zero reading has been made on a master flat surface.

The flatness tester is invaluable for determining the condition of flat ring-

shaped laps used on lapping machines. It permits the establishment of definite wear allowances, and the selection of two laps of the same degree of curvature for surfacing together to secure flat laps. It eliminates the need of a third surface in scraping or lapping two surfaces together, as, if two surfaces fit each other and measure the same with the instrument, they are known to be flat.

Van Keuren 45 and 60-Deg. Shop Triangles

Those very common and useful drafting room tools—the 45 and 60 deg. triangles—are now available in cast and



Longer Blade Life with WHALE BRAND

Whale Brand Hack Saw Blades provide longer blade life, faster cutting and less breakage.

The large, round gullet (1), keen, sharp edge (2), and undercut tooth (3) combine to give you the utmost in hack saw blade performance.

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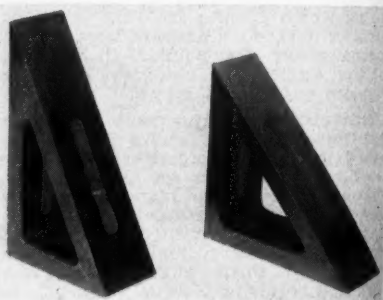
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Send for our new bulletin and learn how to cut die costs 30% to 60%.

OLIVER INSTRUMENT CO.
1430 E. Maumee Street, Adrian, Michigan



Van Keuren Shop Triangles

machined form for use in production and tool departments. The triangles, shown in the illustration, are being marketed by The Van Keuren Company, 14 Copeland St., Watertown, Mass.

The triangles are made of close-grained, well seasoned cast iron, and are provided with slots in each face for bolting to each other, to the machine, or for clamp-

MECHANICAL DEVICES

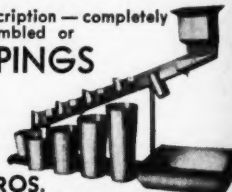
of every description—completely assembled or

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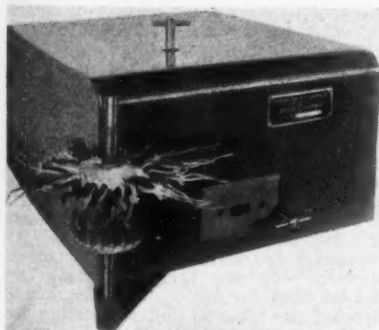


ing parts that are to be laid out or machined. In the sizes illustrated, the 60-deg. triangle is approximately of 3-in. base, 5-in. height, and $1\frac{1}{2}$ in. thickness, while the 45-deg. triangle is of $3\frac{3}{8}$ in. base and height and $1\frac{1}{2}$ in. thickness. All faces and angles are ground to a close degree of precision.

It can easily be seen that the use of the triangles will greatly facilitate the production of parts which have corresponding angles or angles which are multiples of 30, 45, 60, or 90 degrees. In pairs, the triangles make excellent adjustable parallels for laying out, setting up, or inspection of work. Other combinations include equilateral triangles, square, rectangles, and parallelograms.

"Globe" Wire Skinner

Copper wire that has been insulated by the use of enamel, cotton with enamel, double cotton with enamel, silk with enamel, or rubber, can be "skinned" clean and ready for connecting or soldering by the use of the Globe Wire Skinner, shown in the illustration. The wire skinner, which is made by The Globe Tool &



Globe Wire Skinner with armature in position to have the leads "skinned"

Engineering Co., 420 Davis Ave., Dayton, Ohio, will "skin" any of the above-mentioned wire from No. 34 size to No. 12, at a high rate of speed.

The skinning operation is performed by special wire brushes that operate at extremely high speed; presentation of the covered wire to these brushes gives perfectly clean copper ready for soldering, removing the toughest enamel. The brushes are mounted on precision ball-bearing spindles, the mechanism being



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151 Circuit Ave.
SPRINGFIELD, MASS.

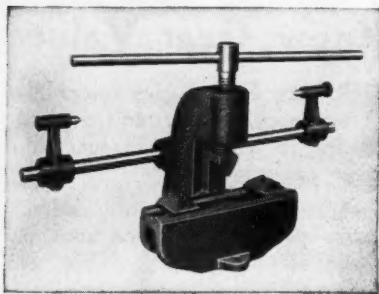
driven by a $\frac{1}{2}$ -h. p. motor of any voltage. Adjustment is provided for brush wear, also for taking up the belt.

The operator is fully protected from danger or injury, as the wire is fed into the machine through a slot narrow. An exhaust system removes all lint and dust and deposits it in a water pan to avoid danger of fire, as lint is inflammable. Stacks of coils can be placed on a bar and the leads lined up and passed through the slot of the Skinner, producing clean wire in a few seconds.

"Western" Straightening Press

A straightening press with which, by hand power, a pressure of six tons can be developed, has been placed on the market by The Western Tool & Mfg. Co., Springfield, Ohio. The press is especially adaptable for straightening or bending, or for pressing bushings in or out. Rods up to two inches diameter can be bent or straightened in this press.

The test centers are of hardened steel, and have a capacity up to 30 inches in length. The height of the press is 18 in., the length of the base is 14 in., width of



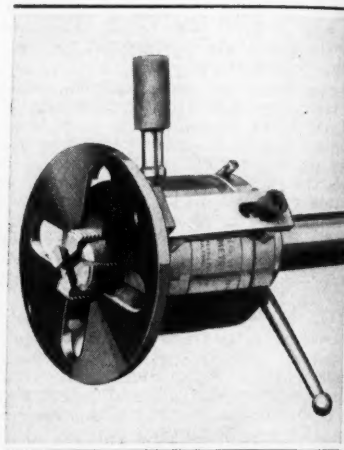
"Western" Straightening Press

base, $3\frac{1}{2}$ in., depth overall, 14 in., and the weight complete is 150 lb. The screw is $1\frac{1}{2}$ in. diameter, 5 pitch Acme thread.

Geometric Class PS Collapsing Tap

A collapsing tap designed for use on a wide range of work on shallow depth tapping or where it is necessary to clear obstructions or projections at the bottom of the hole, to be designated as the Class PS Collapsing Tap, has been brought out by The Geometric Tool Company, New Haven, Conn. The trip on

this tap is extremely sensitive and may be operated either by the conventional trip plate or it may be used as a lever



Geometric Class PS Collapsing Tap

trip tool without the necessity of obtaining extra parts.

The tap is built for use as a stationary tap only. The closing action is at right angles to the axis of the tool, with the chasers being positively cammed open and closed. After the thread has been cut to the desired depth and the chasers automatically released, the chasers are set in cutting position by the conveniently-placed handle. The chasers are held in place in the body of the tool by means of a key and keyway.

Chasers are furnished for this line of taps in only one thread length. They can be used for bottoming work, and by altering the chasers and supporting boss a bit, the tap will clear obstructions or projections at the bottom of the hole. The tap is built in three sizes, covering a range of from $1\frac{1}{8}$ up to 6 in. Any one tap will handle a wide range also, the 3-in. size, for example, covering all diameters from $1\frac{1}{8}$ in. up to 3 inches.

Numberall Rotary Steel Stamp

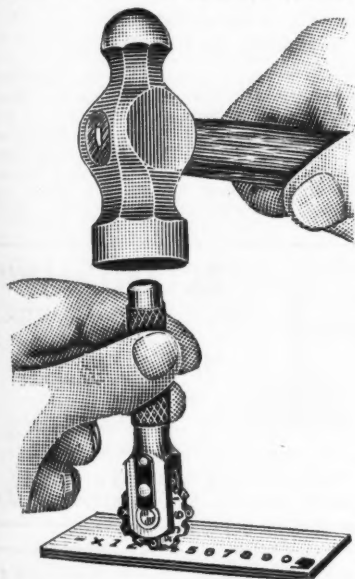
The Numberall Stamp & Tool Co., 370 Huguenot Ave., Huguenot Park, Staten Island, N. Y., is now making a rotary steel stamp in which a complete set of figures or letters are combined on a wheel that can be revolved so as to bring

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The
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 $\frac{1}{4}$ in.
acters

any desired number or letter into position for stamping.

The wheels are of the highest grade of tool steel, scientifically hardened in a "Hump" electric furnace. The characters are engraved by the modern "pantograph" engraving method. Each stamp is inspected and tested on a Rockwell Hardness Testing Machine and the limits for hardness are held within plus or minus three points on the C Rockwell scale.

The fact that all the characters are included on one wheel makes it impossible for any of them to become misplaced, and as all characters are attached to the one handle, the design makes for speed and convenience. The tool can be furnished with one wheel carrying numerals from 1 to 0, or carrying half of the alpha-



Numberall Rotary Steel Stamp

bet, in which case two tools are necessary to provide a complete alphabet. Or the tool can be furnished with two wheels to stamp from 00 to 99 or with two wheels carrying the complete alphabet. A date stamp with three wheels can also be supplied.

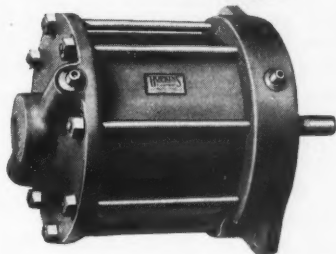
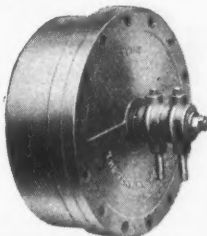
The tools can be furnished singly, or in sets in a metal box. Figures are either $\frac{1}{8}$ in. or $\frac{1}{4}$ in., as desired. Special characters can be supplied if required.

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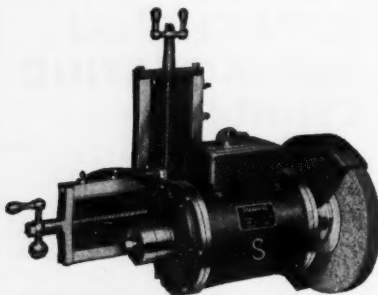
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Jackson, Michigan

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Special roll or parallel grinding can be done conveniently and economically with



"Standard" Angle Plate Grinder

the "Standard" Angle Plate Grinder, which has been brought out by The Standard Electrical Tool Co., 1940 West Eighth St., Cincinnati, Ohio. The illustration shows the 2 h.p. machine, fitted with a horizontal feed of 11 in. and a

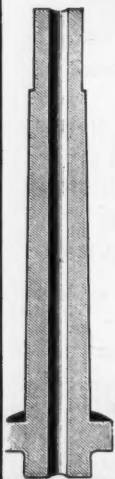
vertical feed of 6 in. If longer or shorter feeds are preferred, the machine can be so arranged or can be furnished with one feed only.

The grinder is especially adapted for use on a lathe, planer, boring mill, or on a milling machine for grinding large milling cutters. It can also be used to grind large shear blades without removing the blades from their machine. The rotating parts of the grinder are balanced, eliminating vibration and providing for long wear. The grinder is furnished in sizes of $\frac{1}{4}$, 1, 2, and 3 h. p. The wheel spindle, which is of nickel steel, runs in ball bearings mounted in dust proof chambers. The switch is located on the motor housing.

Furnas Style R 1 Drum Switch Bulletin

Bulletin No. 2, issued by Furnas Electric Company, 1525 So. 77th St., West Allis, Wis., describes the Style R1 $\frac{1}{2}$ h.p. Drum Switches for reversing fractional h.p. motors made by this firm. The drum switches were originally designed for use with small bench lathes, but they may be used for practically any other appli-

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cation where it is desired to reverse small motors. They may also be used for plain starting and stopping where accurate control is an important consideration.

In addition to a complete description of the Style R1 Drum Switch, the bulletin contains some useful information regarding reversible motors. Copies are available to readers of this magazine without charge.

"The Mechanics of Lubrication with Colloidal Graphite"

A question that has been asked many times is "Does the addition of graphite to ordinary lubricants increase their efficiency?"

Technical Bulletin No. 200.3, issued by the Acheson Oildag Company, Port Huron, Michigan, answers the question in a manner which, while necessarily technical, is so written that it is easily understood by any person who is interested in the subject. The function of a lubricant is defined and the behavior of colloidal graphite in meeting the conditions of the definition is explained in detail. The bulletin is illustrated with explanatory graphs, and reports from research laboratories are quoted.

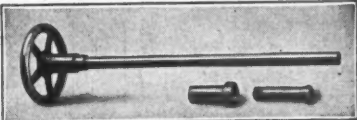
The subject of lubrication is all-important, and such information as is contained in this bulletin should be of prime interest to plant owners and mechanical executives. Copies free.

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Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than five.

Lubrication by Barrel-To-Bearing System: The most modern system of lubrication for machine tools is described in a folder that can be had by writing to Alemite Corporation, 2680 N. Crawford Ave., Chicago, Ill.

Chucks—Key and Keyless: Bulletin No. 120A, 632, and 633, issued by T. R. Almond Mfg. Co., Ashburham, Mass., describe and illustrate the line of key and keyless geared nut and ball bearing drill chucks made by this firm. Copies free upon request.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine & Tool Co., 200 Davis Avenue, Dayton, Ohio. Sent free upon request.

Irregular contours on dies or tools can be finished accurately and fast by the use of the No. 2 Baker Grinder. Write Baker Brothers, Inc., Toledo, Ohio, for descriptive bulletin.

Drop Forged Steel Die Sets: The economy and other advantages of drop forged steel die sets, which are now being made by E. A. Baumbach Manfg. Co., 1806 South Kilbourne Avenue, Chicago, Ill., are explained in a folder that can be had by addressing this firm.

Bushings and Bearings: 500 sizes of finished bronze bushings that are available immediately are shown in a catalog that can be had by writing to The Bunting Brass & Bronze Co., Toledo, O.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Steel Spacing Washers: Milling jobs can be set up quicker by using standard spacing washers, made by Detroit Stamping Co., 1345 West Fort Street, Detroit, Michigan. Write for information.

"Speed" Spot Welders for welding metals from 0.0005 in. to $\frac{1}{2}$ in. thick are described in a catalog that can be had by addressing Eisler Electric Corp., 761 South 13th Street, Newark, N. J.

Performance Data On Swiss Jig Bore: This 36-page pamphlet shows various types of jobs from a power shovel turntable jig to a television disc, drilled and bored on Societe Genevoise High Speed Precision Bore, giving data as to size of holes, accuracy and time savings. Free upon request to The R. Y. Ferner Co., 1008 K Street, N. W., Washington, D. C.

Secret of Fast Cutting: Use a hack saw blade with the correct tooth-clearance angle so that the metal will be cut—not pushed. Full information can be had by asking Forsberg Manfg. Co., 125 Scaview Ave., Bridgeport, Conn., for bulletin on "Whole Brand" Hack Saw Blades.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock-Absorbing Gears, and containing a fund of valuable data with rules and tables for

laying out, cutting, and using gears can be had by addressing Formica Insulation Co., 4632 Spring Grove Ave., Cincinnati, O.

Tool Grinding Costs can be cut by using the "Economy" face milling cutter. Write to J. E. Freyman & Sons, 3627 Keswick Road, Baltimore, Md., for information.

Motorize Your Machine Tools: A compact, roller bearing electric power unit which can be mounted in any position, in sizes from $\frac{1}{4}$ to 10 h. p., is described in a bulletin which can be obtained by addressing W. C. Furnas, 1525 South 77th Street, West Allis, Wis.

Stampings of any kind or size can be obtained from Greling Brothers, 5 East Third Street, Cincinnati, Ohio. Write for particulars.

Ball and Roller Bearings, either journal or thrust, for all purposes and all sizes, are described and illustrated in catalog No. 9 which has been issued by The Gwilliam Company, 360 Furman Street, Brooklyn, N. Y. Copy free upon request.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hirth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hirth Lathe & Tool Company, 60 State Street, Boston, Mass. Copy free upon request.

Pyrometers: Inexpensive portable and stationery, single unit and multi-circuit pyrometers are described in a catalog issued by Illinois Testing Laboratories, Inc., 146 West Austin Avenue, Chicago, Ill. Copy free upon request.

Oil and Waterproof Chucks: The J & H Electric Co., 202 Richmond Street, Providence, R. I., is now making a chuck that is oil and waterproof, and is designed to provide a maximum of holding surface with exceptionally strong and uniform pull throughout. Ask for complete information.

Solve Your Tapping Problems with a Jarvis Tapper. Tapping devices for every type of job. Write The Charles L. Jarvis Co., Gildersleeve, Conn., for information and prices.

Dress Your Grinding Wheels Better, in less time, with less waste of wheel and diamond by using Koebel Multi-Point Diamond Dresser. Write Koebel Diamond Tool Co., 1200 Oakman Blvd., Detroit, Michigan, for details.

Do you buy the same cutter over and over again? Every time you grind a cutter on an old-fashioned time-wasting cutter grinding machine, you are paying for new cutters that you never get. Let the Landis Tool Company, Waynesboro, Pa., tell you how to save this money. Write today.

Threading Machinery: Complete catalogs of individual bulletins covering the pipe threading and cutting machines, bolt threading machines, or die needs made by Landis Machine Co., Waynesboro, Penna., may be had upon request from this firm. State size and type of machine or die head.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Magic Chucks: Instantaneous change of tool without stopping the machine spindle can be accomplished by the use of Modern Magic Chucks, made by the Modern Tool Works, Rochester, N. Y. Write for descriptive booklet.

Compound Spot-Facing Tool: A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

Speed Reducers: Speed Reducers to obtain any desired reduction up to 24,000 to 1 are described and illustrated in Catalog 29-A, issued by The Ohio Gear Co., 1335 East 179th St., Cleveland, O. Copy free upon request.

Die Making Machines: How dies, templates, pages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines, is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

Good Gears of all kinds—spur, spiral, bevel, worm, hypoid—in fact any kind or type of gear desired, large or small, machined to an excellent finish and the highest degree of accuracy, may be obtained from Perkins Machine & Gear Co., 151 Circuit Ave., Springfield, Mass. Write for estimates.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-A, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershaft, individual motor drive jackshaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Flat Steel Wire to Meet Specifications of the most exacting buyers is now being made by John A. Roebeling's Sons Company, Trenton, N. J. Send your specifications and ask for prices.

Foot-Controlled Air-Valve: Air-operated equipment can now be controlled by valves that are operated by the foot, leaving the hands free to operate the machine. Write for information to the Ross Operating Valve Co., 6488 Epworth Blvd., Detroit, Michigan.

Steel Stamps and Marking Dies: Full information as to steel stamps, steel roller dies, embossing dies, and embossing rolls made by the Schwedrite Stamp Co., 10 Cannon Street, Bridgeport, Conn., can be had by writing this firm.

Simonds Files: A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

"Modern Engineering Data On Belt Drives"

This book, containing thirty-two 8½ x 11-in. pages, is a mine of information for the plant manager, plant engineer, or other mechanical executive who is concerned with the transmission of power within the plant.

The book is divided into three sections, as follows: Information on leather belt drives, Tables, and Technical Information. In the first section the text is sub-divided under the following headings: Properties of Leather Belting for Power Transmission; How To Design a Leather Belt Drive; Miscellaneous Information, in which the reader is taken in order through the subjects of Motor Drives, General Drives, Special Drives,

An Electric Hand Shear will save time, material, and labor on jobs that are too small, too large, too complicated, or too cumbersome to be handled in the power shear. Ask The Stanley Electric Tool Co., New Britain, Conn., for catalog.

A Visible Record of Performance of your machines will enable you to keep check on the production of each unit. Ask Stewart-Warner Corporation, 1826 Diversey Parkway, Chicago, Ill., for the booklet on "Tachometer Application To Industrial Machines."

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, 1608 Walnut Street, Philadelphia, Penna. Free upon request.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tompkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Protection and Beauty can be added to the selling points of your product by applying a metal coat of Udylyte-Cadmium. Ask Udylyte Process Co., 3939 Bellevue Ave., Detroit, Michigan, for complete information as to equipment required, methods, costs, etc.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati, Ohio.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, surface grinders, toolpost grinders, and bench and floor grinders is described in Catalog No. 33, published by The United States Electric Tool Co., 2471 West Sixth Street, Cincinnati, Ohio. Copy free.

"Extra Value" Hack Saw Blades: Hack saw blades made of an alloy in which molybdenum is used, and which are said to withstand shock and wear to an unusual degree are now being made by Victor Saw Works, Middletown, N. Y. Full particulars will be sent upon request.

Silent Steel Gears: The two important advantages of silence and durability are combined in the Waldron Laminated Silent Steel Gear, marketed by Smith & Serrell, 20 Washington Place, N. J. Write for sizes, cutting directions, prices.

Crossed Belt Drives, Crown of Pulleys, Difficult Atmospheric Conditions, Distance Between Pulley Centers, Dressing, Fasteners, Fly-wheel Effect, Group Drives, High Speed Drives, Idler Pulley Drives, Pivoted Motor Base Drives, Pulleys, Quarter Turn and Mule Drives, Speed Ratios, Vertical Drives, Waterproof Belts.

The "Technical Information" Section contains all the various formulae and tables that are commonly used in figuring belting, horsepower of motors, indicated horsepower of steam engines, and so on.

The book is published by Alexander Brothers, Inc., 401 North Third St., Philadelphia, Pa., and copies are available without charge to any mechanical executive or engineer who will address this firm on his firm letter-head.

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